Solid State Relays
Industrial, 1-Phase ZS w. LED and Built-in Varistor
Types RA 23, RA 40, RA 48, RA 60

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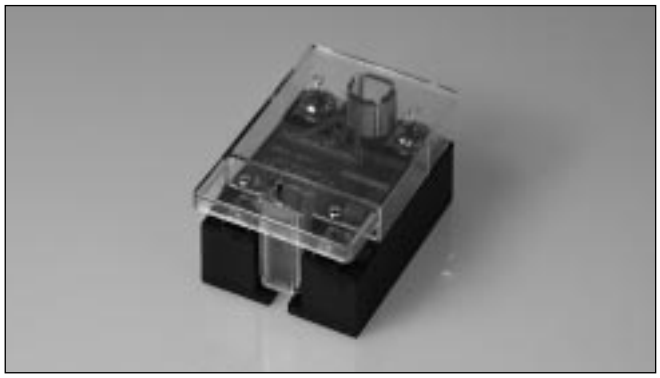

- **Zero switching AC Solid State Relay**
- **Direct copper bonding (DCB) technology**
- **LED indication**
- **Built-in varistor**
- **Input range: 5 - 32 VDC**
- **Rated operational current: 10, 25, 50, 90 and 110 AACrms**
- **Rated operational voltage: 230, 400, 480 and 600 VACrms**
- **Non-repetitive voltage: Up to 1600 V_p**
- **Opto-insulation: > 4000 VACrms**
- **Cover for touch protection**

Product Description

The zero switching relay with antiparallel thyristor output is the most widely used industrial SSR due to its multiple application possibilities. The relay can be used for resistive, inductive and capacitive loads. The zero switching relay switches ON when the sinusoidal curve crosses zero and switches OFF when the current crosses zero. The built-in varistor secure transient protection for the heavy industrial applications and the LED indicates the status of the control input. The cover is securing touch protection.

Ordering Key

RA 23 25 -D 06 D

- **Solid State Relay**
- **Switching mode**
- **Rated operational voltage**
- **Rated operational current**
- **Control voltage**
- **Non-rep. peak voltage**
- **LED indication**

Type Selection

Switching mode	Rated operational voltage	Rated operational current	Control voltage	Non-rep. voltage
A: Zero Switching	23: 230 VACrms 40: 400 VACrms 48: 480 VACrms 60: 600 VACrms	10: 10 AACrms 25: 25 AACrms 50: 50 AACrms 90: 90 AACrms 110: 110 AACrms	-D: 5 to 32 VDC	06: 650 V_p 08: 850 V_p 12: 1200 V_p 16: 1600 V_p

Selection Guide

Rated operational voltage	Non-rep. voltage	Control voltage	Rated operational current 10 AAC	25 AAC	50 AAC	90 AAC	110 AAC
230 VACrms	650 V_p	5 - 32 VDC	**RA2310-D06D**	**RA2325-D06D**	**RA2350-D06D**	**RA2390-D06D**	**RA23110-D06D**
400 VACrms	850 V_p	5 - 32 VDC	**RA4010-D08D**	**RA4025-D08D**	**RA4050-D08D**	**RA4090-D08D**	**RA40110-D08D**
480 VACrms	1200 V_p	5 - 32 VDC	**RA4810-D12D**	**RA4825-D12D**	**RA4850-D12D**	**RA4890-D12D**	**RA48110-D12D**
600 VACrms	1600 V_p	5 - 32 VDC	**-**	**-**	**RA6050-D16D**	**RA6090-D16D**	**RA60110-D16D**

General Specifications

	RA 23... -D06D	RA 40... -D08D	RA 48...-D12D	RA 60... -D16D
Operational voltage range	24 to 280 VACrms	42 to 440 VACrms	42 to 530 VACrms	42 to 660 VACrms
Non-rep. peak voltage	650 V_p	850 V_p	1200 V_p	1600 V_p
Varistor voltage	275 VACrms	420 VACrms	510 VACrms	680 VACrms
Zero voltage turn-on	< 20 V	< 20 V	< 20 V	< 20 V
Operational frequency range	45 to 65 Hz	45 to 65 Hz	45 to 65 Hz	45 to 65 Hz
Power factor	> 0.5	> 0.5	> 0.5	> 0.5
CE-marking	Yes	Yes	Yes	Yes
Norm fulfilled	EN 50082-2	EN 50082-2	EN 50082-2	EN 50082-2

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Input Specifications

Control voltage range (-10% to +10%)	5 to 32 VDC	Input current @ 24 VDC	< 10 mA
Pick-up voltage	4.5 VDC	Response time pick-up	< 10 ms
Drop-out voltage	1 VDC	Response time drop-out	< 20 ms
		Green LED indication	Yes

Output Specifications

	RA ..10 -D..D	RA ..25 -D..D	RA ..50 -D..D	RA ..90 -D..D	RA ..110 -D..D
Rated operational current AC1	10 AACrms	25 AACrms	50 AACrms	90 AACrms	110 AACrms
AC3	3 AACrms	5 AACrms	15 AACrms	20 AACrms	30 AACrms
Minimum operational current	200 mA	200 mA	200 mA	200 mA	200 mA
Rep. overload current (t = 1 s)	< 35 AACrms	< 55 AACrms	< 125 AACrms	< 150 AACrms	< 200 AACrms
Non-rep surge current (t = 20 ms)	160 A_p	250 A_p	600 A_p	1000 A_p	1500 A_p
Off-state leakage current at rated voltage and frequency	< 6 mA	< 6 mA	< 6 mA	< 6 mA	< 6 mA
I^2t for fusing (t = 10 ms)	130 A^2s	310 A^2s	1800 A^2s	5000 A^2s	11250 A^2s
Critical dI/dt	100 A/µs	100 A/µs	100 A/µs	100 A/µs	100 A/µs
On-state voltage drop at rated current	< 1.6 Vrms	< 1.6 Vrms	< 1.6 Vrms	< 1.6 Vrms	< 1.6 Vrms
Critical dV/dt	500 V/µs	500 V/µs	500 V/µs	500 V/µs	500 V/µs
Zero crossing detection	Yes	Yes	Yes	Yes	Yes

Thermal Specifications

	RA ..10 -D..D	RA ..25 -D..D	RA ..50 -D..D	RA ..90 -D..D	RA ..110 -D..D
Operating temperature range	-20° to +70°C (-4 to +158°F)	-20° to +70°C (-4 to +158°F)	-20° to +70°C (-4 to +158°F)	-20° to +70°C (-4 to +158°F)	-20° to +70°C (-4 to +158°F)
Storage temperature range	-40° to +100°C (-40 to +212°F)	-40° to +100°C (-40 to +212°F)	-40° to +100°C (-40 to +212°F)	-40° to +100°C (-40 to +212°F)	-40° to +100°C (-40 to +212°F)
Junction temperature	< 125°C (< 257°F)	< 125°C (< 257°F)	< 125°C (< 257°F)	< 125°C (< 257°F)	< 125°C (< 257°F)
R_{th} junction to case	2.0 K/W	1.25 K/W	0.65 K/W	0.35 K/W	0.30 K/W
R_{th} junction to ambient	12 K/W	12 K/W	12 K/W	12 K/W	12 K/W

Insulation

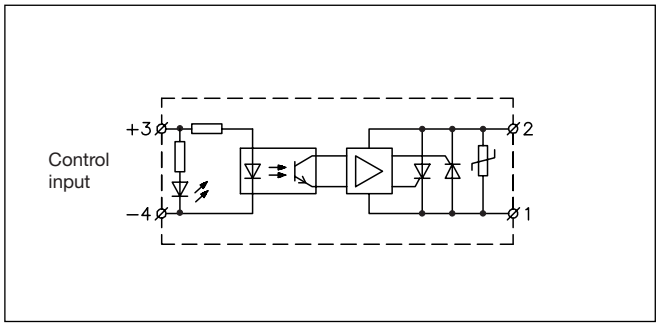
Rated insulation voltage Input to output	≥ 4000 VACrms
Rated insulation voltage Output to case	≥ 4000 VACrms

Accessories

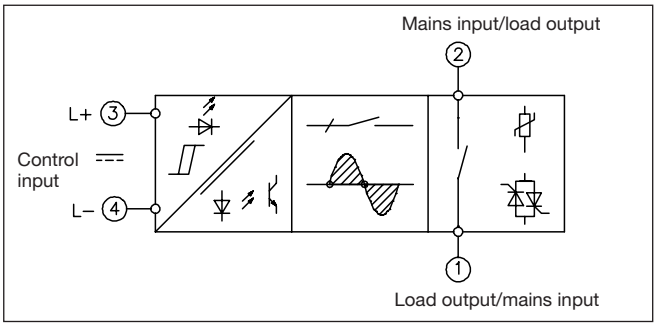
Heatsinks
DIN-rail adapter
Fuses

For further information refer to "General Accessories".

Wiring Diagram



Functional Diagram



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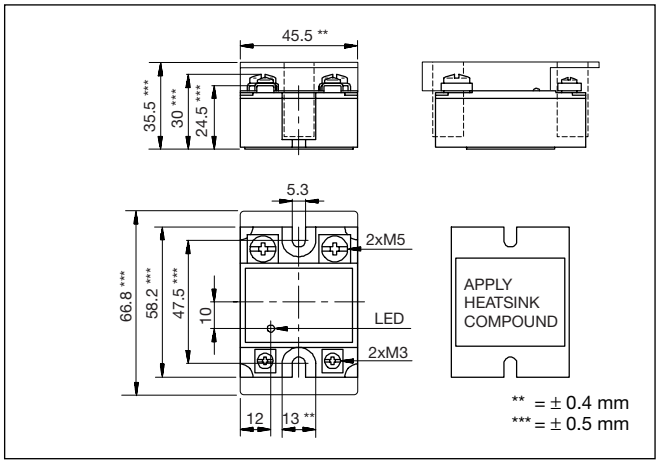
Dimensions



Housing Specifications

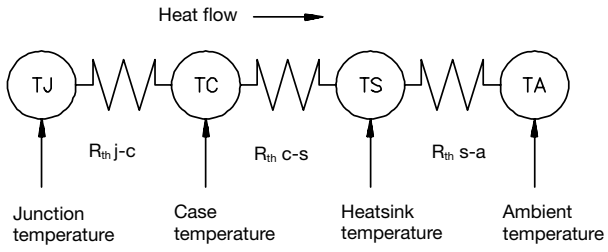
Weight	Approx. 110 g
Housing material	Noryl GFN 1, black
Base plate 10 A, 25 A, 50 A 90 A, 110 A	 Aluminium, nickel-plated Copper, nickel-plated
Potting compound	Polyurethane
Relay Mounting screws Mounting torque	 M5 1.5 Nm
Control terminal Mounting screws Mounting torque	 M3 x 6 0.5 Nm
Power terminal Mounting screws Mounting torque	 M5 x 6 2.4 Nm

Applications

This relay is designed for use in applications in which it is exposed to high surge conditions. Care must be taken to ensure proper heatsinking when the relay is to be used at high sustained currents. Adequate electrical connection between relay terminals and cable must be ensured.

Thermal characteristics
The thermal design of Solid State Relays is very important. It is essential that the user makes sure that cooling is adequate and that the maximum junction temperature of the relay is not exceeded.

If the heatsink is placed in a small closed room, control panel or the like, the power dissipation can cause the ambient temperature to rise. The heatsink is to be calculated on the basis of the ambient temperature and the increase in temperature.

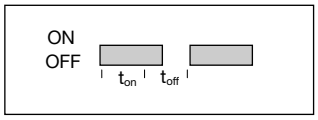


Thermal resistance:
R_{th} j-c = junction to case
R_{th} c-s = case to heatsink
R_{th} s-a = heatsink to ambient

Direct bonding
In the design of the output power semiconductor direct bonding of the copper layer and the ceramic substrate has been applied. This is to ensure uninhibited heat transfer and high thermal fatigue strength.

The relay has been designed for applications requiring large numbers of load cycles.

Power dissipation
The power dissipation for intermittent use is calculated according to the following formula:



$$I_{rms} = \sqrt{\frac{I_{ON}^2 \times t_{ON}}{t_{ON} + t_{OFF}}}$$

Ex: RA 23 50 -D 06D:
Load current = 45 A
t_{ON} = 30 s
t_{OFF} = 15 s

$$I_{rms} = \sqrt{\frac{45^2 \times 30}{30 + 15}}$$

The rms current will be 36.7 A.

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Heatsink Dimensions (load current versus ambient temperature)

RA ..10 -D..D

Load current [A]	Thermal resistance [K/W]						Power dissipation [W]
16	2.7	2.2	1.8	1.3	0.87	0.41	22
15	3.1	2.6	2.1	1.7	1.2	0.65	20
14	3.7	3,1	2.6	2	1.5	0.92	18
13	4.3	3.7	3.1	2.5	1.9	1.2	16
12	5	4.3	3.7	3	2.3	1.6	15
11	5.9	5.1	4.4	3.6	2.8	2.1	13
10	6.9	6	5.2	4.3	3.5	2.6	12
9	7.9	6.9	5.9	4.9	4	3	10
7	10.8	9.5	8.1	6.8	5.4	4.1	7
5	-	14.2	12.2	10.2	8.1	6.1	5
3	-	-	-	-	14.6	10.9	3
	20	30	40	50	60	70	T_A

Ambient temp. [°C]

RA ..25 -D..D

Load current [A]	Thermal resistance [K/W]						Power dissipation [W]
25	2	1.7	1.4	1	0.71	0.40	32
22.5	2.5	2.1	1.8	1.4	1	0.66	27
20	3.1	2.7	2.3	1.9	1.4	1	23
17.5	4.	3.5	3	2.5	2	1.4	20
15	4.9	4.3	3.7	3.1	2.5	1.9	16
12.5	6.2	5.4	4.6	3.9	3.1	2.3	13
10	8.1	7.1	6.1	5.1	4	3	10
7.5	11.3	9.9	8.5	7.1	5.6	4.2	7
5	-	15.6	13.3	11.1	8.9	6.7	5
2.5	-	-	-	-	18.7	14	2
	20	30	40	50	60	70	T_A

Ambient temp. [°C]

RA ..50 -D..D

Load current [A]	Thermal resistance [K/W]						Power dissipation [W]
50	0.92	0.76	0.60	0.45	0.29	-	63
45	1.2	0.99	0.80	0.62	0.44	0.26	55
40	1.5	1.3	1.1	0.85	0.63	0.42	47
35	1.9	1.6	1.4	1.1	0.89	0.63	40
30	2.4	2.1	1.8	1.5	1.2	0.91	33
25	3	2.7	2.3	1.9	1.5	1.1	26
20	3.9	3.5	3	2.5	2	1.5	20
15	5.5	4.8	4.1	3.4	2.7	2.1	15
10	8.6	7.5	6.4	5.4	4.3	3.2	9
5	17.9	15.6	13.4	11.2	8,9	6.7	4
	20	30	40	50	60	70	T_A

Ambient temp. [°C]

RA ..90 -D..D

Load current [A]	Thermal resistance [K/W]						Power dissipation [W]
90	0.63	0.53	0.42	0.32	-	-	97
80	0.81	0.69	0.57	0.45	0.33	-	84
70	1	0.89	0.75	0.61	0.47	0.33	71
60	1.3	1.2	1	0.83	0.66	0.49	59
50	1.7	1.5	1.3	1.1	0.85	0.64	47
40	2.2	1.9	1.7	1.4	1.1	0.83	36
30	3.1	2.7	2.3	1.9	1.5	1.2	26
20	4.8	4.2	3.6	3	2.4	1.8	17
10	10	8.8	7.5	6.3	5	3.8	8
	20	30	40	50	60	70	T_A

Ambient temp. [°C]

RA ..110 -D..D

Load current [A]	Thermal resistance [K/W]						Power dissipation [W]
110	0.43	0.35	0.27	-	-	-	126
90	0.63	0.53	0.42	0.32	-	-	97
80	0.81	0.69	0.57	0.45	0.33	-	84
70	1	0.89	0.75	0.61	0.47	0.33	71
60	1.3	1.2	1	0.83	0.66	0.49	59
50	1.7	1.5	1.3	1.1	0.85	0.64	47
40	2.2	1.9	1.7	1.4	1.1	0.83	36
30	3.1	2.7	2.3	1.9	1.5	1.2	26
20	4.8	4.2	3.6	3	2.4	1.8	17
10	10	8.8	7.5	6.3	5	3.8	8
	20	30	40	50	60	70	T_A

Ambient temp. [°C]

Heatsink Selection

Carlo Gavazzi Heatsink (see Accessories)	**Thermal resistance**
No heatsink required	$R_{th\ s\text{-}a}$ > 12.5 K/W
RHS 100 Assy	3.0 K/W
RHS 301 Assy	0.8 K/W
RHS 301 F Assy	0.25 K/W
Consult your distributor	< 0.25 K/W

Compare the value found in the current versus temperature chart with the standard heatsink values and select the heat-sink with the next lower value.